Energy Balance–Related Behavior and Anthropometric Measures Among Adolescents Across Three Educational Levels

Ridder, Monica A.M.; Koning, Maaike; Visscher, Tommy L.S.; Hirasing, Remy A.; Seidell, Jacob C.; Renders, Carry M.

published in
Health Education and Behavior
2018

DOI (link to publisher)
10.1177/1090198117715666

document version
Publisher's PDF, also known as Version of record

HEALTH EDUCATION & BEHAVIOR

Health Education & Behavior
2018, Vol. 45(3) 349–358

DOI: 10.1177/1090198117715666
journals.sagepub.com/home/heb
SAGE

Energy Balance–Related Behavior and Anthropometric Measures Among Adolescents Across Three Educational Levels: A Cross-Sectional Study in Dutch Schools

Monica A. M. Ridder, PhD[1,2], Maaike Koning, MA[1], Tommy L. S. Visscher, PhD[1,2,3], Remy A. Hirasing, PhD[4], Jacob C. Seidell, PhD[1,3], and Carry M. Renders, PhD[1,3]

Abstract

Energy balance–related behavior on schooldays and beliefs about school-based interventions may differ between students in different educational levels, sexes, and BMI (body mass index) categories. In Zwolle (the Netherlands), 1,084 adolescents (13-15 years) at 9 secondary schools completed a questionnaire. Overweight prevalence (boys 18.1%, girls 19.3%) increased with decreasing educational level, especially in boys. Girls reported healthier behavior than boys regarding daily consumption of fruit (35% vs. 29%), vegetables (58% vs. 48%), ≤1 snack/candy (36% vs. 26%), ≤3 glasses of sugared drinks (80% vs. 73%; all $p < .05$). Unhealthier dietary behaviors were associated with lower educational level, except for eating sugary and savory snacks. Snacks and sugared drinks consumed at school were mostly brought from home (61.6% and 68.5%, respectively). Overweight students reported less frequent consumption of daily breakfast, snacks, and sugared drinks than nonoverweight students. Of all students, 40% spent ≥1 hour per day cycling to school. Lower educational level students reported less organized sports activities than higher level students, but more outside play and other activities. Overweight was associated with cycling to school (boys) and participating in organized sports (girls). More girls than boys were interested in lessons about healthy nutrition (44.4% vs. 31.7%). To stimulate physical activity, boys suggested more physical education classes (63%), girls advised more variation (47%) and choice (43%). A healthy school canteen (57%) and offering free fruit (67%) were suggested as promising interventions to stimulate healthy behavior. Educational and environmental interventions to tackle unhealthy dietary and physical activity behavior should be developed in collaboration with parents and tailored to educational level and gender.

Keywords

adolescents, dietary behavior, overweight, physical activity, school-based health promotion

Childhood obesity can lead to short- and long-term health problems (Daniels, 2006; Whitaker, 2011) and is associated with adult obesity (Singh, Mulder, Twisk, van Mechelen, & Chinapaw, 2008). Adolescence is associated with more autonomy, which affects dietary, physical activity, and sedentary behaviors. Because adolescent behavioral patterns are likely to become long-term patterns, interventions targeting adolescents' health behavior are needed (Bauer, Yang, & Austin, 2004).

Since 1980, the prevalence of overweight in Dutch children (2-21 years) has increased twofold to threefold to 14% and obesity prevalence fourfold to sixfold to 2% in 2009 (Schonbeck et al., 2011). In order to tackle this rising prevalence, several Dutch cities, including Zwolle (120,000 inhabitants), have adapted the French EPODE approach, which is called JOGG (Youth on a Healthy Weight) in the

[1]VU University Amsterdam/Windesheim University of Applied Sciences, Zwolle, Netherlands
[2]Windesheim University of Applied Sciences, Zwolle, Netherlands
[3]VU University, Amsterdam, Netherlands
[4]VU University Medical Centre, Amsterdam, Netherlands

Corresponding Author:
Monica A. M. Ridder, Research Centre for the Prevention of Overweight (Zwolle), VU University Amsterdam/Windesheim University of Applied Sciences, PO Box 10090, 8000 GB Zwolle, Netherlands.
Email: mam.ridder@windesheim.nl

Netherlands (Borys et al., 2012; Renders et al., 2010). Implementing school-based interventions is part of this integrated community approach. In a whole school approach, such as the Health Promotion School framework, combining interventions in the social and physical environment has shown promising results (Langford et al., 2014). Moreover, healthy behavior is associated with school performances (Burkhalter & Hillman, 2011).

Dutch schools have a high degree of autonomy in designing learning programs to achieve national key objectives. Three key objectives are related to health behavior: (a) to gain knowledge about body and health, (b) to learn to care for yourself and others, (c) to learn about healthy physical activities (Eurydice, 2007). The secondary education system has three consecutive levels according to the students' intellectual abilities: prevocational, senior general, and pre-university education. Generally, the curriculum includes 3 to 4 weekly hours of physical education (PE) in all levels. In the prevocational level, more time is spent on health education than in higher education levels (19 vs. 14 lessons). Most school canteens offer healthy and less healthy food (Mikolajczak, Berg, & Bemelmans, 2012).

The differentiated school system offers the opportunity to tailor health education to the intellectual abilities and needs of students. Available theoretically grounded interventions predominantly target prevocational students, who often have a low social-economic background and an increased risk of adapting unhealthy lifestyles (Bessems et al., 2012; Kropski, Keckley, & Jensen, 2008; van Dorsselaer et al., 2010; Singh, Chin, Brug and van Mechelen, 2007). It remains unclear whether these interventions are also necessary for higher educational level students and, if so, are appropriate. This study aims to discern differences in overweight prevalence and dietary, physical activity, and sedentary behavior of students in different educational levels and their beliefs about school-based health interventions in order to provide input for interventions, tailored to the needs of the differentiated adolescent school population.

Method

Design

CheckTeen is a cross-sectional study among second-grade students (age 13-15 years) of secondary schools in Zwolle, the Netherlands. All 12 secondary schools were invited to participate and 75% ($n = 9$) accepted. Three schools declined participation because they were involved in another study.

Data collection took place between November 2010 and December 2011 and consisted of a digital questionnaire on sociodemographic characteristics; dietary, physical activity, and sedentary behaviors; and beliefs about school-based interventions, followed by anthropometric measurements (height, body weight). The questionnaire was filled out in the presence of a teacher and a research assistant. Based on a pretest on four groups of prevocational second-grade students in another region, the questionnaire was shortened and the instructions were simplified. Parents were informed by letter and a website and given the option to withdraw their child from the study. CheckTeen was approved by the Medical Committee of the VU Medical Centre, Amsterdam.

Anthropometric Measurements

Body weight and height were measured according to protocol by school nurses of the local public health service (GGD IJsselland) during the periodic health check, which is part of the nationwide Youth Health Care program (Frederiks, Buuren, Burgmeijer, Verloove-Vanhorick, & Wit, 2002). Age- and gender-specific cutoff points for body mass index (BMI) defined by Cole et al. were used to define the categories: thinness, healthy weight, overweight and obesity (Cole, Bellizzi, Flegal, & Dietz, 2000).

Digital Questionnaire

The digital questionnaire consisted of 72 questions on the students' characteristics; dietary, physical activity, and sedentary behavior on schooldays; and their beliefs about school-based overweight prevention. The questions on dietary, physical activity, and sedentary behaviors were based on questionnaires from a comparable study in the same city targeting primary school children (4-13 years; de Jong, Schokker, Visscher, Seidell, & Renders, 2011). Ethnicity was dichotomized as non-Western background (one or both parents born in Turkey, Morocco, Surinam, Netherlands Antilles) versus Dutch or Western background (both parents born in the Netherlands or in a country not specified; de Jong et al., 2011).

Dietary Behavior

Students indicated the frequency of eating breakfast, fruit and vegetables, the frequency and number of glasses of fruit juice, soft drinks (excluding diet soft drinks), energy drinks, and sweetened dairy drinks per day, and the frequency and amount of sweets, candy bars, cookies, savory snacks, and crisps per day. Dietary behaviors were dichotomized based on dietary standards recommended for adolescents by the Dutch Nutrition Centre and the Dutch Health Council (2006): eating breakfast daily, daily consumption of ≥1 portion of fruit, ≥1 portion of vegetables, ≤3 glasses of sugared drinks, and ≤1 snack or candy. Students also reported the frequency of consumption and the source of snacks/candy and sugared drinks consumed during school hours.

Physical Activity and Sedentary Behavior

The physical activity behavior items consisted of outside play, participating in organized sports, other activities (e.g., side

job, paper route), and active commuting to school. Sedentary behavior items concerned TV/video/DVD viewing and computer use (for recreation and homework). Students indicated the frequency and time (five categories: <0.5, 0.5-1.0, 1-2, 2-3, >3 hours/day) spent on these activities on schooldays and for organized sports on all days of the week. The average time per school day spent on each activity was calculated.

As 90% of the students cycled to school, active commuting time was calculated only for cycling students based on the indicated frequency and distance between home and school and an average cycling speed of 12.5 km/h. Active commuting, outside play, and other activities were dichotomized as >1 hour or ≤1 hour of the activity per day, and organized sports was dichotomized as >1 hour or ≤1 hour per week, based on the Dutch standard for exercise for youth (Kemper, Ooijendjik, & Stiggelbout, 2000). TV/video/DVD viewing was dichotomized as ≤2 hours or >2 hours per school day (American Academy of Pediatrics, 2001). The same cutoff was used for computer use and total screen time (TV/video/DVD + computer use).

Perceptions and Beliefs

Students indicated their perceived weight status on a 5-point Likert-type scale (much too thin, a little too thin, just about right, a bit overweight, very overweight). Perceived dietary and physical activity behaviors were indicated by comparing personal behavior to other students' behavior on a 4-point Likert-type scale ([totally] agree, [totally] disagree): I eat healthier/am more active than most other students (de Nooijer & de Vries, 2007). Questions on beliefs about school-based health promotion were based on an existing questionnaire for adolescents (van Exel, de Graaf, & Brouwer, 2006) and the results of focus group interviews with the target group (Ridder, Heuvelmans, Visscher, Seidell, & Renders, 2010). Students were asked to (totally) agree or (totally) disagree with statements regarding interventions on a 4-point Likert-type scale and to select two best interventions from a list.

Analysis

Statistical analyses were performed using SPSS for Windows, version 20.0 (SPSS Inc., Chicago, IL). The level of significance for all statistical tests was set at $p < .05$ (two-sided). Chi-square tests were used to identify differences in behavior and beliefs about school-based health promotion between students of different gender, educational level, and BMI category. We explored whether the association between educational level and dietary and physical activity behavior was modified by gender (Table 2) and explored the same for the association between educational level and perception of lessons (Table 3). Because of small numbers the BMI categories were dichotomized in overweight (including obesity) versus nonoverweight students (thinness and healthy weight).

Results

Study Population

The digital questionnaire was completed by 1,432 students. Participation was refused by 53 students or their parents (3.6%). Anthropometric measurements of 1,301 students were assessed. Based on the students' name and date of birth, data from both measurements for 1,084 students were combined. The maximum time period between filling out the questionnaire and having anthropometric measurements taken was 8 months. Mean age of the participants was 14.0 year ($SD = 0.55$), 46.6% were boys, 9.2% of the students had a non-Western background, which is in accordance with regional statistics (Table 1). Because the association between educational level and breakfast, other activities, and organized sports differed significantly between boys and girls, results for boys and girls are presented separately.

Body Weight

The prevalence of overweight was similar for boys and girls but differed significantly between prevocational, senior general education, and pre-university levels overall (prevocational 25.3%, senior general education 14.2%, pre-university 12.7%, $p < .001$) and for boys separately (Table 1). Discrepancies were found between the measured BMI category and perceived body weight status. Of the girls, 35.2% perceived themselves to be too fat, while 19.3% was categorized as being overweight. In contrast, 14.5% of the boys considered themselves too thin, while 3.8% was classified underweight. Up to 25.3% of the healthy weight girls considered themselves to be too fat, against 9.4% of the healthy weight boys ($p < .001$). Of the overweight boys, 40% judged their body weight as "just about right" against 23.2% of the overweight girls ($p < .002$; whole group, data not shown).

Dietary Behavior

Girls reported significantly healthier dietary behaviors than boys, except for having daily breakfast (Table 2). At most one snack per school day was eaten by 35.9% of the girls and 25.5% of the boys. Overall, 32.3% of the students reported daily consumption of fruit and 53.0% reported daily consumption of vegetables. The percentage of students (boys and girls) who had a daily breakfast, daily fruit and vegetables consumption, and drank less than 3 glasses of sugared drinks per school day increased significantly with educational level.

Compared with nonoverweight students, overweight students significantly indicated less often daily breakfast consumption (70.6% vs. 78.9%, $p = .012$). Overweight boys reported healthier dietary behaviors than nonoverweight boys with regard to snack consumption (40.7% vs. 22.0%, $p < .001$) and consumption of sugared drinks (81.3% vs. 71.2%, $p = .049$). No differences in dietary behavior were found between nonoverweight and overweight girls.

Table 1. BMI and Perception of Body Weight for Students of Different Educational Levels (Prevocational, Senior General, and Pre-university Level) and Different Sex (n = 1,084).

	Boys				Girls				All students		
Characteristics	Prevocational (n = 199)	Senior general (n = 141)	Pre-university (n = 165)	p value*	Prevocational (n = 224)	Senior general (n = 138)	Pre-university (n = 217)	p value	Boys (n = 505)	Girls (n = 579)	p value
Age (year ± *SD*)	14.4 ± 0.54	14.0 ± 0.48	13.8 ± 0.48	<.001[a,b,c]	14.2 ± 0.50	13.9 ± 0.46	13.7 ± 0.46	<.001[a,b,c]	14.1 ± 0.57	13.9 ± 0.52	<.001
Ethnicity (%)											
Non-Western	12.6	8.5	5.5	.061	12.1	7.2	6.9	.119	9.1	9.3	.956
Height (cm ± *SD*)	170.3 ± 8.2	169.6 ± 9.8	168.0 ± 8.8	.043[a]	165.0 ± 6.6	164.7 ± 6.2	165.7 ± 6.0	.348	169.4 ± 8.8	163.2 ± 6.3	<.001
Weight (kg ± *SD*)	60.8 ± 13.0	56.7 ± 11.4	54.6 ± 9.0	<.001[a]	57.3 ± 11.1	55.1 ± 9.1	55.0 ± 8.8	.024[a]	57.6 ± 11.7	55.9 ± 9.8	.008
BMI (kg/m^2 ± *SD*)	20.9 ± 3.8	19.5 ± 2.6	19.2 ± 2.3	<.001[a]	21.0 ± 3.6	20.3 ± 3.1	20.0 ± 3.2	.004[a]	20,0 ± 3.1	20.4 ± 3.2	.120
BMI category[#] (%)											
Thinness	3.5	7.1	1.2	.026[c]	3.1	4.3	4.1	.796	3.8	3.8	.971
Healthy weight	71.4	78.7	86.1	.003[a]	72.8	79.7	79.3	.188	78.2	77.1	.679
Overweight/ obesity	25.3	14.2	12.7	.003[a,b]	24.1	15.9	16.6	.074[a,b]	18.1	19.1	0.671
Perception body weight (%)											
(Much) too thin	11.1	16.3	17.0	.213	9.4	10.9	7.8	.628	14.5	9.2	.005
Just about right	65.3	66.0	70.3	.567	49.1	61.6	58.5	.040[b]	67.1	55.6	<.001
(Much) too fat	23.6	17.7	12.7	.028[a]	41.5	27.5	33.6	.024[b]	18.4	35.2	<.001

Note. *SD* = standard deviation; BMI = body mass index.

[a]Statistically significant relation between prevocational and pre-university students. [b]Significant relation between prevocational and senior general students. [c]Significant relation between senior general and pre-university students ($p \leq .05$).

*A p value $\leq .05$ indicates a statistically significant difference over the three educational levels.

[#]BMI categories are based on age- and gender-specific cutoff points, that are extrapolated from the adult BMI cutoffs of ≤18.5 kg/m^2 (thinness), 25 to 30 kg/m^2 (overweight), and ≥30 kg/m^2 (obesity).

Table 2. Dietary, Physical Activity, and Sedentary Behavior of Students of Different Educational Levels (Prevocational, Senior General, and Pre-university Level) and Gender on Schooldays (n = 1,084).

	Boys				Girls				All students		
Behaviors	Pre-vocational (n = 199)	Senior general (n = 141)	Pre-university (n = 165)	p value[#]	Pre-vocational (n = 224)	Senior general (n = 138)	Pre-university (n = 217)	p value	Boys (n = 505)	Girls (n = 579)	p value
Dietary Behavior (% Students Who Meet the Criteria)											
Daily breakfast*	68.6	74.5	90.3	<.001[a,c]	64.7	84.1	85.7	<.001[a,b]	77.4	77.2	.960
≥1 portion fruit/day	21.6	30.5	37.7	.005[a]	25.9	32.6	46.1	<.001[a,c]	29.1	35.1	.037
≥1 portion vegetables/day	41.7	48.2	55.2	.038[a]	45.5	58.0	69.6	<.001[a,b,c]	47.9	57.5	.002
≤3 g sugared drinks/day	63.8	75.2	82.4	<.001[a,b]	72.3	78.3	89.9	<.001[a,c]	73.1	80.3	.004[a,c]
≤1 snack or candy/day	23.1	22.0	31.5	.098	34.4	32.6	39.6	.523	25.5	35.9	<.001
Perception behavior: Healthier than others	38.7	49.6	58.2	<.001[a]	30.4	39.9	46.1	.002[a]	48.1	38.5	.001
Physical Activity (PA) (% Students Who Meet the Criteria)											
Outside play and sports >1 hour/day	27.6	14.9	12.1	<.001[a,b]	21.0	9.4	10.1	.001	19.0	14.2	.032[a,b]
Other activities (hobby, job) >1 hour/day*	25.1	14.2	6.7	<.001[a,b,c]	15.2	8.7	12.4	.227	16.0	12.6	.109
Participation in organized sports >1 hour/week*	66.3	74.5	80.6	.009[a]	52.5	76.8	79.6	<.001[a,b]	73.3	68.5	.083
Active commuting to school (cycling) >1 hour/day	42.2	34.0	46.7	.079[c]	34.4	35.5	44.7	.059[a]	41.4	38.5	.359
Perception PA: Healthier than others	51.3	51.8	62.4	0.024[a,c]	28.1	41.3	47.9	<.001[a,b]	55.0	38.7	<.001
Sedentary Behavior (% Students Who Meet the Criteria)											
Watching TV ≤2 hour/day	67.8	75.2	89.1	<.001[a,c]	67.4	79.7	86.6	<.001[a,b]	76.8	77.5	.751
Using computer ≤2 hour/day	64.8	70.2	77.6	.029[a]	73.2	78.3	82.0	.083[a]	70.5	77.7	.007
Total screen time ≤2 hour/day	26.6	31.2	42.4	.005[a,c]	31.3	34.8	40.6	.120[a]	33.1	35.6	.363

[a]Significant relation between prevocational and pre-university students. [b]Significant relation between prevocational and senior general students. [c]Significant relation between senior general and pre-university students ($p \leq .05$).
[#]A p value ≤ .05 indicates a statistically significant difference over the three educational levels.
*Significant interaction for educational level by gender for breakfast, other activities, and participation in organized sports.

Table 3. Perception of the Lessons About Healthy Eating and Physical Education (% Students Who Agreed With the Statement) of Students of Different Educational Levels (Prevocational, Senior General, and Pre-university Level; n = 1,084).

	Boys				Girls				All		
Perceptions	Prevocational (n = 199)	Senior general (n = 141)	Pre-university n=165	p value[#]	Prevocational (n = 224)	Senior general (n = 138)	Pre-university (n = 217)	p value	Boys (n = 505)	Girls (n = 579)	p value
Lessons About Healthy Eating (% Students Agreeing With the Statement)											
I learn enough about healthy eating	70.4	47.5	50.3	<.001[a,b]	60.3	44.9	42.4	.001[a,b]	57.4	49.9	.007
I would like to learn more about preparing healthy food	39.2	36.9	38.8	.852	48.7	47.8	48.8	.979	38.4	48.4	.002
I find lessons about healthy eating interesting	33.7	31.2	29.7	.751	42.0	46.4	45.6	.619	31.7	44.4	<.001
I talk with my parents about what I learn about healthy food*	32.2	22.0	23.6	.071[b]	25.9	34.1	24.4	.101	26.5	27.3	.941
Due to lessons I have improved my healthy eating habits	24.6	14.2	10.9	.002[a,b]	19.6	20.3	12.0	.055[a,c]	17.2	16.9	.768
Physical Education (PE) Lessons (% Students Agreeing With the Statement)											
I think we have sufficient PE lessons	62.3	51.1	50.9	.040[a,b]	78.6	79.0	73.7	.411	55.4	76.9	<.001
I would like to learn more about how to be sufficiently and healthily active	42.7	45.4	34.5	.169	40.6	45.7	36.9	.256	40.8	40.4	.728
I like PE lessons	93.0	92.9	90.3	.892	79.5	85.5	79.3	.148	92.1	80.8	<.001
Due to lessons I have become more active in sports in my spare time*	37.7	29.8	18.2	<.001[a,c]	23.7	26.1	18.4	.218	29.1	22.3	.007

[a]Significant relation between prevocational and pre-university students. [b]Significant relation between prevocational and senior general students. [c]Significant relation between senior general and pre-university students ($p \leq .05$).
[#]A p value $\leq .05$ indicates a statistically significant difference over the three educational levels.
*Significant interaction for educational level by gender for the statements: "I talk with my parents about what I learn about healthy food" and "Due to lessons I have become more active in sports in my spare time."

More boys than girls perceived their dietary behavior as healthier than other students' behavior (48.1% vs. 38.5%, p = .001). The perception of a healthier dietary behavior compared with others increased with educational level (boys p < .001, girls p = .002). Nonoverweight students significantly more often considered their dietary behavior as healthier compared with others than overweight students (46.1% vs. 32.7%, p = .001).

Of all students, 30.9% reported to eat snacks and 32.2% to consume sugared drinks at least 3 days per week at school. The majority of these students brought snacks and sugared drinks from home (61.6% and 68.5%, respectively), while a minority purchased these at school (19.7% and 11.2%, respectively) or in a store (14.9% and 17.4%, respectively). Nonoverweight girls more often brought drinks from home compared with overweight girls (77.7% vs. 59.9%, p < .001), while more

overweight than nonoverweight girls bought drinks at school (10.0% vs. 16.5%, $p = .051$) or a nearby store (8.9% vs. 19.3%, $p = .002$). This difference was not found in boys.

Physical Activity and Sedentary Behavior

Most students (90.0%) indicated that they cycled to school daily, 41.4% of the boys and 38.5% of the girls spent >1 hour per day actively commuting (Table 2). Significantly more boys than girls reported spending >1 hour per school day on outside play (19.0% vs. 14.2%). Significant differences on an educational level were found: prevocational students reported most often to spend time playing outside (%) and having other activities, while pre-university students most often participated in organized sport (Table 2). Overweight girls reported less involvement in organized sports than nonoverweight girls (59.1% vs. 70.7%, $p = .019$). Overweight boys less often commuted >1 hour per school day by bicycle compared with nonoverweight boys (31.9% vs. 43.6%, $p < .040$).

The amount of daily screen time was ≥2 hours for 66.9% of the boys and 64.4% of the girls. More girls than boys spent <2 hours on the computer per school day (77.7% vs. 70.5%).

Beliefs About School-Based Interventions (Table 3)

Significantly more girls than boys disagreed with the statement that the education on healthy eating is sufficient (51.1% vs. 42.6%). More girls than boys would like to learn more about preparing food (51.6% vs. 41.6%) and found the lessons about healthy eating interesting (44.4% vs. 31.7%). More prevocational than higher educational level students agreed that the education on healthy eating was sufficient and had improved their dietary habits due to the lessons. Students considered a healthy school canteen (57%) and offering free fruit (67%) the most promising interventions.

More girls (76.9%) than boys (55.4%) found the amount of PE lessons sufficient, while more boys than girls enjoyed the PE lessons (92.1% vs. 80.8%) or had become more active due to lessons (29.1% vs. 22.3%). Differences in educational level were found in boys only, the prevocational students being most positive about the amount of PE lessons (62.3% vs. 51.1% vs. 50.9%), and becoming more active in sports due to lessons (37.5% vs. 29.8% vs. 18.2%). To stimulate physical activity, boys suggested more PE classes (63%), while girls advised more variation (47%) and more choice (43%) in activities.

Discussion

Our aim was to explore differences in overweight prevalence; dietary, physical activity, and sedentary behavior; and beliefs about school-based health interventions in students of different educational levels in Dutch secondary schools.

The prevalence of overweight was highest in prevocational students. Compared with senior general and pre-university students, prevocational students reported unhealthier dietary behaviors, less participation in organized sports, and more outside play. Cycling to school contributed largely to the daily amount of physical activities in most students. At all levels, girls reported healthier dietary behaviors than boys but similar physical activity behaviors. Overweight students indicated they less often consumed daily breakfast, snacks, and sugared drinks on school days than nonoverweight students. With regard to school-based interventions, girls were interested in nutrition and preferred variation and choice in physical activities, while boys suggested offering more physical activities. Prevocational students more often indicated change in their health behavior due to lessons than higher educational level students.

Perception Body Weight Status

Girls perceived their body weight status differently than boys. The influence of gender on health behavior was also found in other studies, girls being more aware, critical, and interested in body weight, health, and health behavior than boys (Huang, Norman, Zabinski, Calfas, & Patrick, 2007; Ojala, Tynjala, Valimaa, Villberg, & Kannas, 2012). Differences in body weight perception related to educational level could be explained by influences from the social and cultural environment. Personal standards for a healthy body weight are influenced by peers and social economic background (Mueller, 2015; Shin & Nam, 2015). Misperception of body weight may lead to unhealthy dieting or not engaging in healthy behaviors (van Vliet, Gustafsson, & Nelson, 2016). Therefore, body weight perception needs to be addressed, when teaching students about a healthy body weight. Furthermore, more should be learned about determinants of body weight perception.

Dietary Behavior

Prevocational students and overweight students tended to skip breakfast, which is an indicator of unhealthy dietary behavior and negatively associated with cognitive performance at school (Cooper, Bandelow, Nute, Morris, & Nevill, 2012; Rampersaud, Pereira, Girard, Adams, & Metzl, 2005; Wesnes, Pincock, & Scholey, 2012).

On average, the daily consumption of fruit (32.3%) and vegetables (52.7%) was low. Fruit and vegetables were mostly eaten at home, so parent involvement is needed to ameliorate this (Ridder et al., 2010). Parent involvement is also needed to reduce snack consumption. Two thirds of the students ate at least one snack every day. Although overweight students reported lower snack consumption than nonoverweight students, they more often bought snacks in or nearby school, while nonoverweight students brought those goods from home. Possibly, the dietary choices of overweight adolescents are less supervised by their parents than those of nonoverweight students (Goossens, Braet, & Decaluwe, 2007; Hilbert, Tuschen-Caffier, & Czaja, 2010).

The reported consumption of sugared drinks is relatively low compared with results of other studies (Brug et al., 2012; Singh et al., 2009) but in line with findings in Zwolle (Visscher et al., 2010) and Canada (Danyliw, Vatanparast, Nikpartow, & Whiting, 2011). Nevertheless, the consumption of sugared drinks should be addressed, as this behavior is strongly related with overweight (Te Morenga, Mallard, & Mann, 2013).

Physical Activity and Sedentary Behavior

We consider the amount of students that cycle to school daily (90%) and play organized sports (71%) as high, and therefore the general physical activity level of the students satisfactory. In the Netherlands, commuting by bicycle is considered standard and essential behavior by adolescents (Ridder et al., 2010). Differences in physical activity were mostly related to educational level. Possibly, social and economic conditions needed to participate in organized sports are less favorable for prevocational students (Ridder et al., 2010). It should be noted that it is not clear in this study how "other activities" and "outside play" were interpreted by students and how vigorous these activities are. Overweight girls participated less in organized sports than nonoverweight girls, and overweight boys spent less time on active commuting to school compared with nonoverweight boys, which is in line with findings in the United States (Drake et al., 2012). More frequent sports participation and active commuting can reduce the risk of obesity. In order to prevent a decline in physical activity with increasing age, active commuting should be kept attractive for youth and schools and local sports clubs should collaborate to initiate sports club membership, that continues after graduation (Bélanger, Gray-Donald, O'Loughlin, Paradis, & Hanley, 2009; Zick, Smith, Brown, Fan, & Kowaleski-Jones, 2007).

The total amount of screen time increased with educational level and is expected to increase in all students even more in the future, considering the growing popularity of screen-based recreation and increased use of e-learning (Atkin, Sharp, Coder, & van Sluijs, 2014). Therefore, students should be trained to manage their computer use in a healthy way.

Implications

Compared with data of primary school pupils in the same region, the prevalence of overweight in second grade secondary school students has risen as have unhealthy dietary and sedentary behaviors (de Jong et al., 2011). Our findings confirm the importance of obesity prevention during the adolescent period as dietary patterns track into adulthood (Ambrosini, 2014). Although especially prevocational students seem to be at risk, health behavior of higher level students should also be improved.

Based on the Health Promotion School framework, school health promotion should combine education, environmental changes, and parent involvement. In the differentiated Dutch school system, the curriculum can be tailored to the students' needs and abilities. Besides offering information, health lessons should focus on awareness and perception of body weight and health behavior, taking gender differences into account (Nunez et al., 2014). Changes in the school environment can contribute to highlighting the common standard for health behavior in school. A school canteen with a predominantly healthy food assortment not only stimulates healthy dietary behavior in students but is also a statement for healthy behavior. By providing facilities for safe bicycle parking, the school encourages cycling as means of transportation. The association between healthy behavior and school performances can be a strong motivator to involve parents in stimulating a healthy lifestyle in their children.

Limitations

When interpreting these findings, it should be taken into account that the study had a cross-sectional design. Therefore, no causal inferences can be drawn. Pubertal status of the participants, which can be a determinant of dietary intake, was not assessed (Harris et al., 2015). As the age range of the participants (13-15 years) is relatively small and participants are mostly in their late or postpuberty, we expect little differences in dietary behavior associated with pubertal status. The dietary, physical activity, and sedentary behaviors were measured by self-reported behavior of the students, which is often done for practical reasons (Dupuy, Godeau, Vignes, & Ahluwalia, 2011). Because self-reporting can lead to social desirable answers and underestimation of unhealthy behavior, we asked detailed questions about the frequency and quantity of behaviors in our questionnaire. However, measuring physical activity by a questionnaire remains difficult, because the extent of physical strain is unknown. The anthropometrical measurements and the questionnaire were not executed at the same time because different persons and organizations were responsible for each measurement. Students in second grade have adapted to secondary school lifestyle and developed a routine in their behavior, which will be reflected in their body weight status. The total study population is relatively small for a detailed analysis of differences in subgroups based on gender, educational level, and ethnicity.

Conclusion

The results of the study indicate that although prevocational students are at risk, the dietary and sedentary behaviors of higher level students leave room for improvement too. Moreover, it is important to consolidate healthy dietary and physical activity patterns that track into adulthood. To

realize this, school-based health education at all educational levels should be tailored to educational level and gender.

Declaration of Conflicting Interests

The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: TLSV is a member of the EPODE International Network. EPODE collaborates with commercial partners. His university receives support from EPODE to attend international meetings occasionally.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

Ambrosini, G. L. (2014). Childhood dietary patterns and later obesity: A review of the evidence. *Proceedings of the Nutrition Society*, *73*, 137-146. doi:10.1017/S0029665113003765

American Academy of Pediatrics. (2001). Children, adolescents, and television. *Pediatrics*, *107*, 423-426.

Atkin, A. J., Sharp, S. J., Coder, K., & van Sluijs, E. M. (2014). Prevalence and correlates of screen time in youth: An international perspective. *American Journal of Preventive Medicine*, *47*, 803-807. doi:10.1016/j.amepre.2014.07.043

Bauer, K. W., Yang, Y. W., & Austin, S. B. (2004). "How can we stay healthy when you're throwing all of this in front of us?" Findings from focus groups and interviews in middle schools on environmental influences on nutrition and physical activity. *Health Education & Behavior*, *31*, 34-46.

Bélanger, M., Gray-Donald, K., O'Loughlin, J., Paradis, G., & Hanley, J. (2009). When adolescents drop the ball: Sustainability of physical activity in youth. *American Journal of Preventive Medicine*, *37*(1), 41-49. doi:10.1016/j.amepre.2009.04.002

Bessems, K. M., van Assema, P., Martens, M. K., Paulussen, T. G., Raaijmakers, L. G., de Rooij, M., & de Vries, N. K. (2012). Healthier food choices as a result of the revised healthy diet programme Krachtvoer for students of prevocational schools. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 60. doi:10.1186/1479-5868-9-60

Borys, J. M., Le Bodo, Y., Jebb, S. A., Seidell, J. C., Summerbell, C., Richard, D., . . . Swinburn, B. (2012). EPODE approach for childhood obesity prevention: Methods, progress and international development. *Obesity Reviews*, *13*, 299-315. doi:10.1111/j.1467-789X.2011.00950.x

Brug, J., van Stralen, M. M., Chinapaw, M. J., De Bourdeaudhuij, I., Lien, N., Bere, E., . . . Te Velde, S. J. (2012). Differences in weight status and energy-balance related behaviours according to ethnic background among adolescents in seven countries in Europe: The ENERGY-project. *Pediatric Obesity*, *7*, 399-411. doi:10.1111/j.2047-6310.2012.00067.x

Burkhalter, T. M., & Hillman, C. H. (2011). A narrative review of physical activity, nutrition, and obesity to cognition and scholastic performance across the human lifespan. *Advances in Nutrition*, *2*, 201S-206S. doi:10.3945/an.111.000331

Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide: International survey. *British Medical Journal*, *320*, 1240-1243.

Cooper, S. B., Bandelow, S., Nute, M. L., Morris, J. G., & Nevill, M. E. (2012). Breakfast glycaemic index and cognitive function in adolescent school children. *British Journal of Nutrition*, *107*, 1823-1832. doi:10.1017/S0007114511005022

Daniels, S. R. (2006). The consequences of childhood overweight and obesity. *Future of Children*, *16*(1), 47-67.

Danyliw, A. D., Vatanparast, H., Nikpartow, N., & Whiting, S. J. (2011). Beverage intake patterns of Canadian children and adolescents. *Public Health Nutrition*, *14*, 1961-1969. doi:10.1017/S1368980011001091

de Jong, E., Schokker, D. F., Visscher, T. L., Seidell, J. C., & Renders, C. M. (2011). Behavioural and socio-demographic characteristics of Dutch neighbourhoods with high prevalence of childhood obesity. *International Journal of Pediatric Obesity*, *6*, 298-305. doi:10.3109/17477166.2011.583659

de Nooijer, J., & de Vries, N. K. (2007). Monitoring health risk behavior of Dutch adolescents and the development of health promoting policies and activities: The E-MOVO project. *Health Promotion International*, *22*(1), 5-10. doi:10.1093/heapro/dal036

Drake, K. M., Beach, M. L., Longacre, M. R., Mackenzie, T., Titus, L. J., Rundle, A. G., & Dalton, M. A. (2012). Influence of sports, physical education, and active commuting to school on adolescent weight status. *Pediatrics*, *130*, e296-e304. doi:10.1542/peds.2011-2898

Dupuy, M., Godeau, E., Vignes, C., & Ahluwalia, N. (2011). Socio-demographic and lifestyle factors associated with overweight in a representative sample of 11-15 year olds in France: Results from the WHO-Collaborative Health Behaviour in School-aged Children (HBSC) cross-sectional study. *BMC Public Health*, *11*, 442. doi:10.1186/1471-2458-11-442

Eurydice. (2007). *The education system in the Netherlands*. The Hague, Netherlands: Ministry of Education Culture and Science.

Frederiks, A., Buuren, S. V., Burgmeijer, R., Verloove-Vanhorick, S., & Wit, J. (2002). *Groeidiagrammen. Handleiding bij het meten en wegen van kinderen en het invullen van groeidiagrammen* [Growth charts. Manual for taking anthropometric measurements in children and filling out growth charts]. Leiden, Netherlands: TNO/LUMC.

Goossens, L., Braet, C., & Decaluwe, V. (2007). Loss of control over eating in obese youngsters. *Behaviour Research and Therapy*, *45*(1), 1-9. doi:10.1016/j.brat.2006.01.006

Harris, C., Flexeder, C., Thiering, E., Buyken, A., Berdel, D., & Koletzko, S. (2015). Changes in dietary intake during puberty and their determinants: Results from the GINIplus birth cohort study. *BMC Public Health*, *15*, 841. doi:10.1186/s12889-015-2189-0

Hilbert, A., Tuschen-Caffier, B., & Czaja, J. (2010). Eating behavior and familial interactions of children with loss of control eating: A laboratory test meal study. *American Journal of Clinical Nutrition*, *91*, 510-518. doi:10.3945/ajcn.2009.28843

Huang, J. S., Norman, G. J., Zabinski, M. F., Calfas, K., & Patrick, K. (2007). Body image and self-esteem among adolescents undergoing an intervention targeting dietary and physical activity behaviors. *Journal of Adolescent Health*, *40*, 245-251. doi:10.1016/j.jadohealth.2006.09.026

Kemper, H. C. G., Ooijendjik, W. T. M., & Stiggelbout, M. (2000). Consensus over de Nederlandse norm voor gezond bewegen [Consensus on the Dutch norm for healthy physical activity]. *Tijdschrift Voor Sociale Geneeskunde*, *78*, 180-183.

Kropski, J. A., Keckley, P. H., & Jensen, G. L. (2008). School-based obesity prevention programs: An evidence-based review. *Obesity*, *16*, 1009-1018. doi:10.1038/oby.2008.29

Langford, R., Bonell, C. P., Jones, H. E., Pouliou, T., Murphy, S. M., Waters, E., . . . Campbell, R. (2014). The WHO Health Promoting School Framework for improving the health and well-being of students and their academic achievement. *Cochrane Database of Systematic Reviews*, (4), CD008958. doi:10.1002/14651858.CD008958.pub2

Mueller, A. S. (2015). The role of school contexts in adolescents' weight-loss behaviors and self-perceptions of overweight. *Sociological Inquiry*, *85*(4), 532-555. doi:10.1111/soin.12091

Mikolajczak, J., Berg, S. W. v. d., & Bemelmans, W. J. E. (2012). *Overgewichtpreventie in het voortgezet onderwijs in 2010-2011. Een landelijke vervolgstudie* [Overweight prevention at secondary schools: a nationwide follow-up study]. RIVM report 260701007/2012. Bilthoven, Netherlands: National Institute for Public Health and the Environment (RIVM).

Nunez, A., Robertson-James, C., Reels, S., Jeter, J., Rivera, H., Yusuf, Z., & Liu. (2014). Exploring the role of gender norms in nutrition and sexual health promotion in a piloted school-based intervention: The Philadelphia Ujima experience. *Evaluation and Program Planning*, *51*, 70-71. doi:10.1016/j.evalprogplan.2014.12.010

Ojala, K., Tynjala, J., Valimaa, R., Villberg, J., & Kannas, L. (2012). Overweight adolescents' self-perceived weight and weight control behaviour: HBSC study in Finland 1994-2010. *Journal of Obesity*, *2012*, 180176. doi:10.1155/2012/180176

Rampersaud, G. C., Pereira, M. A., Girard, B. L., Adams, J., & Metzl, J. D. (2005). Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *Journal of the American Dietetic Association*, *105*, 743-760. doi:10.1016/j.jada.2005.02.007

Renders, C. M., Halberstadt, J., Frenkel, C. S., Rosenmoller, P., Seidell, J. C., & Hirasing, R. A. (2010). Tackling the problem of overweight and obesity: The Dutch approach. *Obesity Facts*, *3*, 267-272. doi:10.1159/000319426

Ridder, M., Heuvelmans, M., Visscher, T., Seidell, J., & Renders, C. (2010). We are healthy, so we can behave unhealthily: A qualitative study of the health behaviour of Dutch lower vocational school students. *Health Education*, *110*(1), 30-42.

Schonbeck, Y., Talma, H., van Dommelen, P., Bakker, B., Buitendijk, S. E., Hirasing, R. A., & van Buuren, S. (2011). Increase in prevalence of overweight in Dutch children and adolescents: A comparison of nationwide growth studies in 1980, 1997 and 2009. *PLoS One*, *6*(11), e27608. doi:10.1371/journal.pone.0027608

Shin, A., & Nam, C. M. (2015). Weight perception and its association with socio-demographic and health-related factors among Korean adolescents. *BMC Public Health*, *15*, 1292. doi:10.1186/s12889-015-2624-2

Singh, A. S., Chin, A. P. M. J., Brug, J., & van Mechelen, W. (2007). Short-term effects of school-based weight gain prevention among adolescents. *Archives of Pediatrics & Adolescent Medicine*, *161*, 565-571.

Singh, A. S., Chinapaw, M. J., Brug, J., Kremers, S. P., Visscher, T. L., & van Mechelen, W. (2009). Ethnic differences in BMI among Dutch adolescents: What is the role of screen-viewing, active commuting to school, and consumption of soft drinks and high-caloric snacks? *International Journal of Behavioral Nutrition and Physical Activity*, *6*, 23. doi:10.1186/1479-5868-6-23

Singh, A. S., Mulder, C., Twisk, J. W., van Mechelen, W., & Chinapaw, M. J. (2008). Tracking of childhood overweight into adulthood: A systematic review of the literature. *Obesity Reviews*, *9*, 474-488. doi:10.1111/j.1467-789X.2008.00475.x

Te Morenga, L., Mallard, S., & Mann, J. (2013). Dietary sugars and body weight: Systematic review and meta-analyses of randomised controlled trials and cohort studies. *British Medical Journal*, *346*, e7492. doi:10.1136/bmj.e7492

van Dorsselaer, S., de Looze, M. E., Vermeulen-Smit, E., de Roos, S., Verdurmen, J., ter Bogt, T., & Vollebergh, W. (2010). *Gezondheid, welzijn en opvoeding van jongeren in Nederland. HBSC 2009* [Health, well being and education of young people in the Netherlands. Health Behavior of School Children 2009]. Utrecht, Netherlands: Trimbos Instituut.

van Exel, N. J., de Graaf, G., & Brouwer, W. B. (2006). "Everyone dies, so you might as well have fun!" Attitudes of Dutch youths about their health lifestyle. *Social Science & Medicine*, *63*, 2628-2639.

van Vliet, J. S., Gustafsson, P. A., & Nelson, N. (2016). Feeling 'too fat' rather than being 'too fat' increases unhealthy eating habits among adolescents - even in boys. *Food & Nutrition Research*, *60*, 29530. doi:10.3402/fnr.v60.29530

Visscher, T. L., van Hal, W. C., Blokdijk, L., Seidell, J. C., Renders, C. M., & Bemelmans, W. J. (2010). Feasibility and impact of placing water coolers on sales of sugar-sweetened beverages in Dutch secondary school canteens. *Obesity Facts*, *3*, 109-115. doi:10.1159/000300848

Wesnes, K. A., Pincock, C., & Scholey, A. (2012). Breakfast is associated with enhanced cognitive function in schoolchildren. An internet based study. *Appetite*, *59*, 646-649. doi:10.1016/j.appet.2012.08.008

Whitaker, R. C. (2011). The childhood obesity epidemic: Lessons for preventing socially determined health conditions. *Archives of Pediatrics & Adolescent Medicine*, *165*, 973-975. doi:10.1001/archpediatrics.2011.179

Zick, C. D., Smith, K. R., Brown, B. B., Fan, J. X., & Kowaleski-Jones, L. (2007). Physical activity during the transition from adolescence to adulthood. *Journal of Physical Activity & Health*, *4*(2), 125-137. doi:10.1123/jpah.4.2.125